Computer Aided Standards Development (CASD) – A Software Tool to Automate the Standards Development Process

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Description:

The development of documentary and test standards is a long and tedious process. Challenges facing standards developers include complex, inadequately defined terminology, and rapidly changing associated information content. Even after a standard is "set," its implementation and adoption can be hampered by the gap between the technical requirements of that standard and the technology required to implement those requirements.

NIST seeks a software tool that will make the process of designing and developing documentary standards faster, more robust, and more integrated. The model for this subtopic is the so-called Computer Aided Software Engineering (CASE) tool, itself modeled after the Computer Aided Design (CAD) tool, but applied to standards development and deployment. The tool should provide the following capabilities for standards development and deployment:

- Categorize and organize standards' content in a structured information model, supporting modularization and reuse.
- Establish terminology connections between related standards, and maintain semantic consistency across standards.

- Generate a visual representation and navigation scheme for the standard, so that the standard may be communicated to the end-user through interactive means (such as a touch-screen tablet).
- Provide an underlying formal model that is amenable to testing and verification, and that facilitates the implementation of the standard by automatic or semiautomatic generation of software modules. This should allow software implementers to extract portions of the standard to meet specific implementation requirements

Standards development organizations (SDOs) and the scientific and engineering societies that participate in those organizations will benefit greatly from such a tool. Vendors will benefit from the tool since it would pull from the existing standard, populate the tool, and allow a consistent assessment for the vendor to identify the requirements. NIST will greatly benefit from such a tool to enable better testing of standards for broad industry deployment. Such a tool will also allow NIST to develop metrics to assess the "quality" of a standard, and to verify whether an implementation meets a standard's scope and requirements.

The life-cycle of a standard may involve three broad stages [1]. First is the development stage, in the course of which stakeholders gather within committees, prepare a draft, and come to a consensus on a final standard. The second stage is the deployment stage, which may include a pilot-scale implementation, followed by industry-wide implementation. The third stage is the maintenance stage, in which the standard is revised and maintained. A well-defined underlying information structure/model will facilitate the implementation of all three stages. In addition, it can support the instantiation and communication of the standard to the end-users using the varied digital media available today. Even though information management and software tools have advanced considerably over the recent decades, SDOs rarely take advantage of those advancements.

The goals of this project are the following: 1) Build a framework for developing a taxonomy and ontology for the terminology and concepts contained in a standard; 2) Capture the requirements of a standard in a formal model; and 3) Develop a standard as a structured information model, instead of a simple text document.

Additional tools to automatically verify these models for consistency and generate other artifacts such as documents and software implementation modules can be also developed. All of these will be supported by a tool that will allow standards developers and end-users to interactively view and navigate the information models. Such technology will greatly improve the deployment, adoption, and maintenance of standards.

The outcome of this effort will bring together SDOs, software implementers, and end-users (both manufacturers and their consumers) under a single framework and allow them to exchange standards information in an unambiguous and efficient manner. While the focus of this SBIR subtopic will be related to standards in manufacturing, the general methodology is applicable to other industry sectors.

Phase I activities and expected results:

- Expand on the NIST Ontological Visualization Interface for Standards (NOVIS) tool [2,3] to develop a taxonomy editor for standards. This should include a classification scheme and underlying ontology modeling the concepts and relationships.
- Develop a formal representation scheme to capture the requirements for a standard. This may be based on the Framework for Analysis, Comparison, and Test of Standards (FACTS) work [4].
- Develop an export/import mechanism for the information content of a standard and associated document formats.
- Develop a business case for a Computer Aided Standards Development (CASD) tool working with standards developing organizations, such as, ASME, ASTM, IEEE, OMG, and ISO.

Phase II activities and expected results:

- Design an initial architecture and software for realizing a computer aided tool for standards development.
- Develop a Computer Aided Standards Development (CASD) tool and a comprehensive case study/demonstration.
- Design an interface between a CASD tool and document generation software, in the form of a plug-in to a document editor that interfaces with the underlying CASD model.
- Design a mechanism for automatic or semiautomatic generation of software to implement modules of the standard.
- A framework for a standards repository where the standards may reside as information models. The framework should support version control, cross standard linking, and maintenance of information consistency across standards.

NIST will consult and provide input to assess progress and performance.

References:

1. Cargill, C.F., *Why Standardization Efforts Fail*, The Journal of Electronic Publishing. (2011).

2. Narayanan, A., et al., *A Methodology for Handling Standards Terminology for Sustainable Manufacturing*, NIST Interagency/Internal Report (NISTIR) – 7965. (2013).

3. Lechevalier, D., et al., *NIST Ontological Visualization Interface for Standards User's Guide*, NIST Interagency/Internal Report (NISTIR) – 7945. (2013).

4. Witherell, P.W., et al., *FACTS: A Framework for Analysis, Comparison, and Test of Standards*, NIST Interagency/Internal Report (NISTIR) – 7935. (2013).